R·I·T

Title: Heidelberg DWL66+

Semiconductor & Microsystems
Fabrication Laboratory **Revision: B** **Rev Date: 05/03/2017**

Approved by:

_____ / / _____ / /
Process Engineer Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the Heidelberg DWL66+. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

DWL66+_UG3_User_Guide_1_current
DWL66+_UG5_User_Guide_2_current
DWL66+_UG6_Maintenance_Guide_current
DWL66+_UG7_ConversionJobManager
DWL66+_VPG_small_UG1_Safety_Guide_current

3 DEFINITIONS

n/a

4 TOOLS AND MATERIALS

4.1 **General Description -** The Heidelberg DWL66+ is a direct write system that can write in either vector scan or raster scan modes. The tool is also capable of writing greyscale to create 3D structures in resist by modulating the beam intensity to 255 levels. Acceptable design formats are DXF, Gerber, GDSII and CIF. File conversion to the LIC (Laser Internal Code) machine format is done on the networked Linux PC. Backside alignment can be done using the camera under the substrate with open frame chucks.

4.2 Laser – The system utilizes a 405nm 300mW diode laser. It will not expose SU-8.

4.3 **Vacuum Pump –** The vacuum pump is located behind the tool, and is used for substrate hold down. It is operated with the foot pedal.

4.4 **4mm Write Head –** The 4mm Write Head can be used with either pneumatic or optical focusing to write a minimum feature size of 0.8um. Write speed is 25mm^2/min. Address grid is 20nm.

4.5 **20mm Write Head –** The 20mm Write Head uses pneumatic focusing and has a minimum feature size of 4um. Write speed is 500mm^2/min. The address grid is100nm.

4.6 **Stage –** The interferometer resolution is 10nm. Maximum write size is 200x200mm, while maximum plate size is 225x225mm. Maximum substrate thickness is 6mm.

5 SAFETY PRECAUTIONS

5.1 Hazards to the Operator

5.1.1 **Lasers** – The system uses lasers. Use care not to stare into the beam and do not defeat any interlocks. All covers should be in place during operation.

5.1.2 **High Voltage** – The system uses hazardous voltages. Ensure all covers are in place during operation and do not defeat any interlocks.

5.1.3 **Mechanical** – Mechanical pinch hazards exist in the stage and the window. Use caution when operating.

5.2 Hazards to the Tool

5.2.1 **Cover Removal** – Do not remove any tool covers or operate with covers removed.

5.2.2 **Interferometer Interruption** - Use care not to interrupt the interferometer laser. Never touch the interferometer mirror.

5.2.3 **Write Head Damage** – Users are prohibited from changing the write head. Please contact a staff member before you are ready to use the tool.

5.2.4 **Contamination** – Make sure your substrates and reticles are clean before placing them in the tool

5.2.5 **Locator Pins** – Make sure locator pins are set below the write surface of the substrate to prevent state errors.

5.2.6 **Substrate Mounting** – If a thin substrate or piece needs to be mounted to another substrate, use a small drop of water to stick them together. Tape is not allowed on the writing surface because it will cause stage errors.

6 INSTRUCTIONS

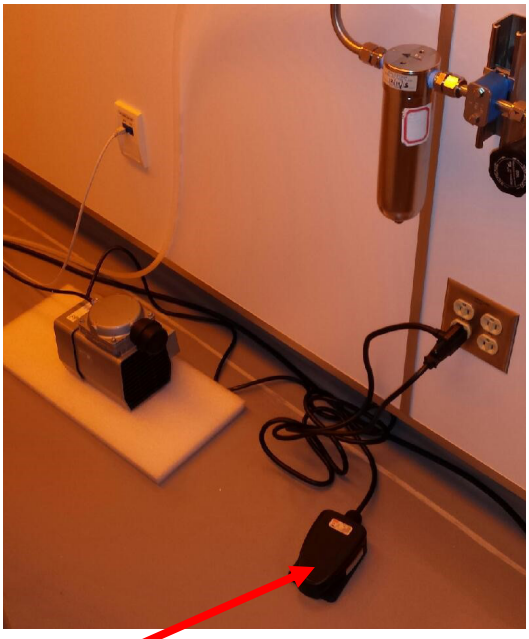
6.1 Starting the System

6.1.1 Verify that the correct write head is installed. If it needs to be changed, contact a staff member for scheduling. Users are not allowed to change the write head.

6.1.2 Swipe the tool in on the Card Swipe System.

6.1.3 On the top of the right side of the tool, verify that the temperature is 21C +/- 0.1C. The temperature should be stable for best results.

6.1.4 Turn on the vacuum pump using the foot pedal on the floor behind the tool.



6.1.5 Verify that the tool and computers are on. The HI icon on the computer should be open. If the tool does not appear to be on, contact a staff member for assistance.

6.2 Loading a GDSII File (or other format)

6.2.1 Plug USB drive containing file into port below monitors

6.2.2 On the computer go to **Computer**, **Convert(\\172.18.47.201)(z:)**. Copy your GDSII file to the **gdsii folder**. For other formats, copy file to the appropriate folder.

6.2.3 Remember to take your USB drive.

6.3 Converting a File to LIC – The GDS or other file must be converted to a special machine format called LIC. This will split the design into a series of stripes that the tool will write to the substrate. At this point it is possible to perform functions, inversion, scaling, mirroring and rotating. There is also a viewer for reviewing your design.

6.3.1 Minimize the Heidelberg Menu. (Do not close it, it needs to remain open) On the desktop open **Convert Prog**.

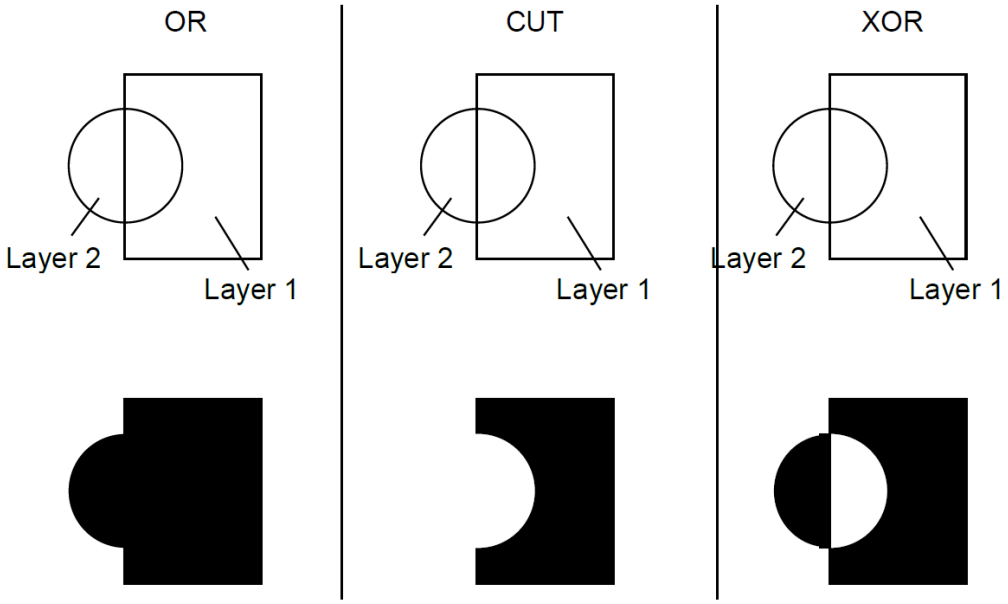
6.3.2 Select **File**, **New Job**, put in a **Job Name** and click **OK**. It is a good idea to include the project or researcher's name, the write head size and the scaling in the jobname. For example *Student_4mm5xASML01* for a 5x ASML job with the 4mm write head, plate #1. This will ensure that the correct job is run when it is time to write, and make file management easier.

6.3.3 In the **GUI HIMT Convert** window, under **Source File** select **Add** and **GDSII**. (or other format)

6.3.4 In the **Load GDSII Design** window, select your GDS file and **Open**.

6.3.5 In the **GDSII Options** window, select the desired layout from **GDSII Structure** (There may only be one). Unselect any layers that will not be used (There may only be one). Verify that the layer or layers that will be used are checked. From the drop down next to the layer number, input the design layer you wish to assign to the reticle layer number. For example layer 5 of a design could be assigned to **Layer 0** of a reticle. If you are only working with 1 layer it is not important whether you call it layer 0 or 1, etc. If doing functions between layers, the order is important.

6.3.5.1 Available functions between 2 layers include **OR**, **CUT** and **XOR**. Inversion is done in step 6.3.7.1.



6.3.5.2 **Scaling** for X and Y may be changed if needed. For example a stepper plate would need to be scaled 5x while a contact plate should be 1x.

6.3.6 Select **Create Default** button.

6.3.7 In the **GUI HIMT Convert** window under **Write Lens**, select either the **4mm** or **20mm**. Please note that a job will only run with the write head that it was converted for. If you want the job to run with both write heads, you will have to convert twice.

6.3.7.1 Select the **Expose Options** tab. When **Not Invert** is displayed, the interior of the boxes will be written. When **Invert** is displayed, the area outside of boxes will be written. If needed, a **CD Bias** and a **Frame** can be added here.

6.3.7.2 Select the **Justification** tab to show the **Expose Window** and include a **border** if needed.

6.3.7.3 In the **Justification** tab, a design can be previewed by selecting the **HIMT Preview** button. Make sure the **TCL** box is not checked. The design may be zoomed and filled. Make sure to close it when done.

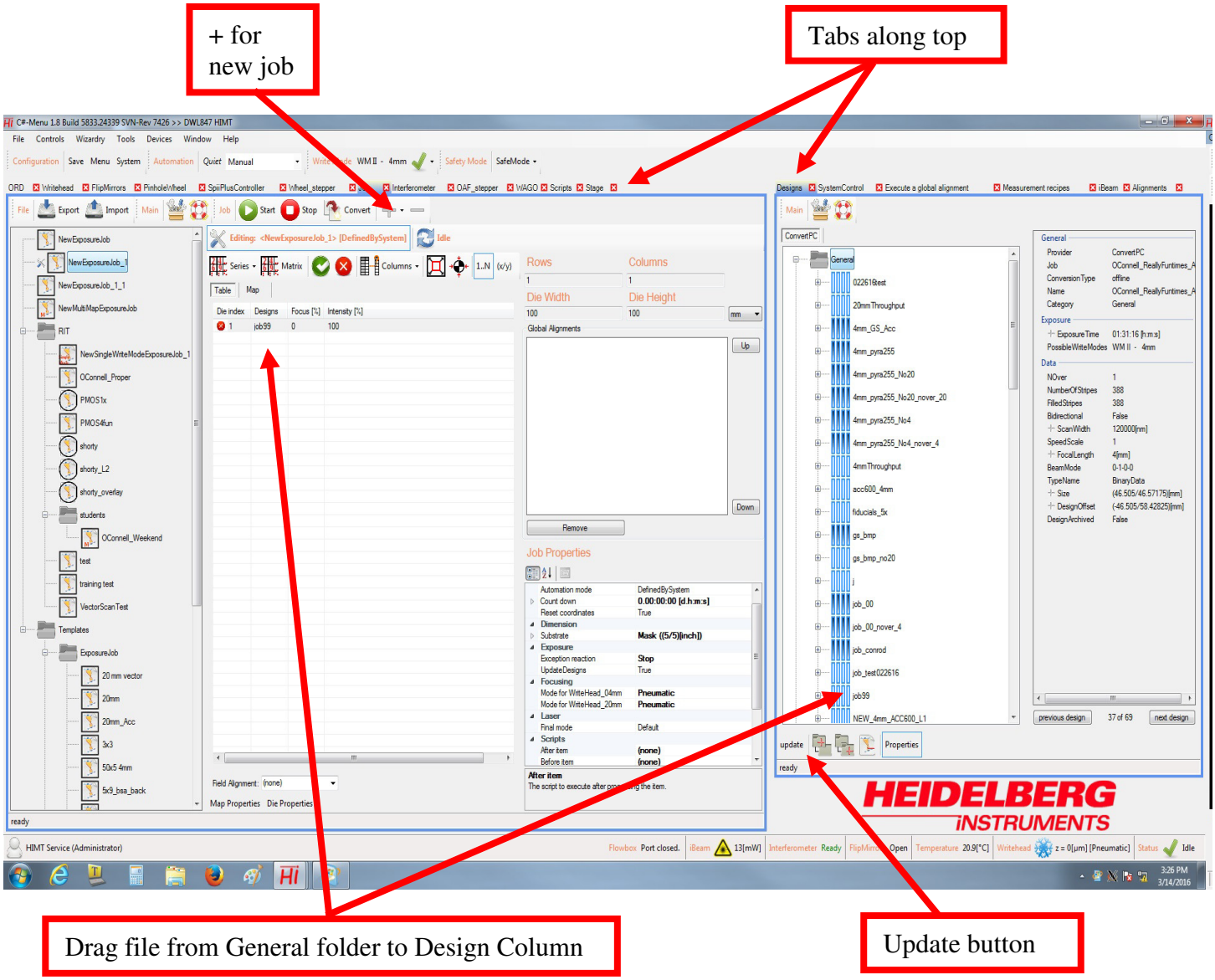
6.3.7.4 Select **Mirroring** and **Rotation**, as needed.

6.3.8 In the bottom of the **GUI HIMT Convert** window, select **Complete Tasks**, **Save** and **OK**. Choose **Expose Offline**. Job will convert and be available. Select **Finish**. Make a note of your job name so that it can be found later.

6.3.9 Close the **GUI HIMT Convert** and **vglconnect**.

6.4 Setting up an Exposure Job – This will allow the converted files to be written to the substrate. You may write a single copy of the converted job, or multiple copies on a direct write wafer. You can set up quad plates for the stepper. Stepper marks and barcode files are already converted and included in files that you may use. There are existing ASML templates that may be copied and used.

6.4.1 Maximize the **HI** icon on the computer.



6.4.2 Under the **Designs** tab, select **Update** near the bottom. Design should be in the list under **General**. *You will always have to update the list after converting a file.*

6.4.3 Select **Job** tab and click **+** to create a new job. From the dropdown menu select **Exposure Job**. Select a substrate type from the dropdown menu.

6.4.4 Set up **Die Size** and number of rows and columns. *You must double click the box before you can make a change.* If you set the die size to zero, you can use the **Die Offset** to place die relative to the center of the plate.

6.4.5 Under the **Table** tab there is a **Designs** column. You may have to resize the columns. Drag your converted file from **General** folder to **Designs** column.

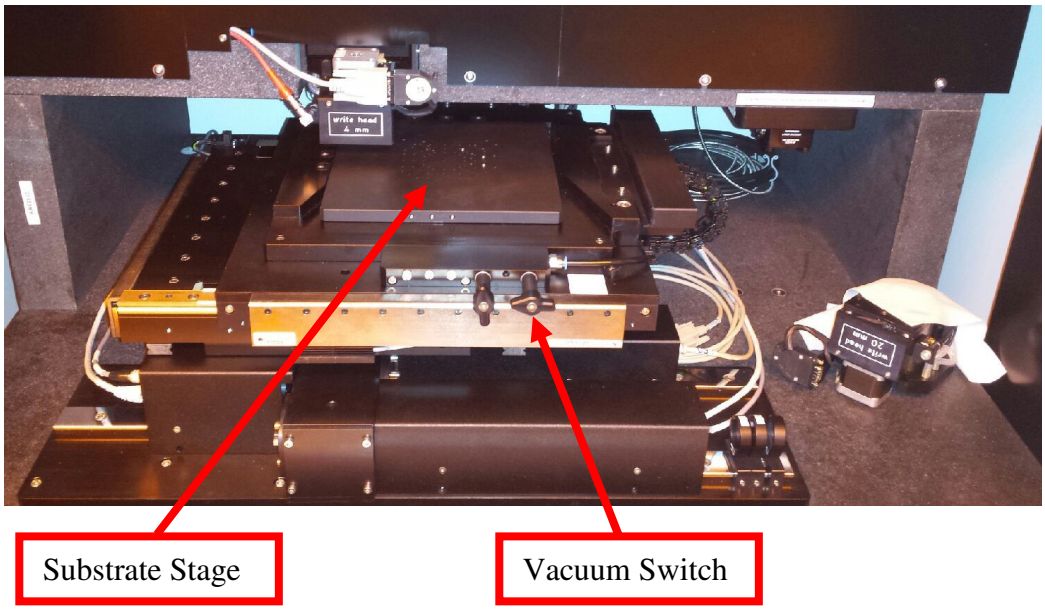
6.4.6 For each row set the **Laser** Power, **Focus** and **Intensity**. Actual values will depend on the resist and write head. *Do not use copy and paste.* Fill in a row, select the rows you want to fill, right click and select **Fill Down**. If one of the columns is missing, you can add it by selecting columns from the top.

6.4.7 To see the layout select the **Map** tab. On the map make sure the center point is at the center of the plate. If your die size is zero, you will not be able to see the map.

6.5 Loading a Substrate – Substrates up to 6mm thick may be written. See a staff member for writing wafers.

6.5.1 Under the **System Control** tab, click the **Up** arrow near **Write head** to move the head up.

6.5.2 Select the **Load** button to bring the stage to the load position. Center the substrate on the chuck and turn on the vacuum. The chuck and locator pins may need to be changed to accommodate a substrate. Use care not to lose any of the pins. Avoid using pins with wafers as they may be too tall.



6.5.3 Select the **Center** button to load the stage under the write head.

6.5.4 Select the **Focus** button to focus on the substrate.

6.5.5 Select the **Plate Center** button to automatically find the center of the plate or wafer.

6.6 Starting a Job

6.6.1 Under the **Job** tab, select the green **Start** button. The system will begin to write and display an estimated completion time. If there are any problems error messages will be displayed.

6.7 Unloading a Substrate

6.5.5 Under the **System Control** tab, click the **Up** arrow near **Write head** to move the head up.

6.5.6 Select the **Load** button to bring the stage to the load position. Turn off the vacuum and remove substrate.

6.5.7 If finished use the foot pedal behind the tool to turn off the vacuum pump.

6.8 Errors during Run

6.8.1 If any errors occur contact a staff member.

7 APPROPRIATE USES OF THE TOOL

7.1 Wafer pieces smaller than 1cm should not be run due to limitations in focusing.

8 ATTACHMENTS

8.1

REVISION RECORD

Summary of Changes	Originator	Rev/Date
Original Issue	Sean O'Brien	A-03/17/2016
Added 5.2.5 and 5.2.6, clarified some procedures	O'Brien	B-05/03/2017